Reg No.:_____ Name:_____

APJ ABDUL KALAM TECHNOLOGICAL UNIVERSITY
SIXTH SEMESTER B.TECH DEGREE EXAMINATION, APRIL 2018

Course Code: CH352
Course Name: COMPREHENSIVE EXAM (CH)

Max. Marks: 50 Duration: 1 Hour

Instructions

(1) Each question carries one mark. No negative marks for wrong answers
(2) Total number of questions: 50
(3) All questions are to be answered. Each question will be followed by 4possible answers of which only ONE is correct.
(4) If more than one option is chosen, it will not be considered for valuation.
(5) Calculators are not permitted

1 For the differential equation $\frac{dy}{dt} + 5y=0$ with $y(0) =1$ the general solution is

a) e^{5t} b) e^{-5t} c) $5e^{-5t}$ d) none of these.

2 The function $f(x)=x^3-6x^2+9x+25$ has

a) a maxima at x=1 and a minima at x=3 b) a maxima at x=3 and a minima at x=1

c) no maxima but a minima at x=1 d) a maxima at x=1 and no minima

3 The maximum and minimum magnitude of resultant force is 1000N and 500 N at a point. What are the values of two forces acting on it

a) 500N,500 N b) 450N,700N c) 250 N,750 N d) 300N,700N

4 The force applied on a body of mass 100 kg to produce an acceleration of 5 m/S^2 is

a) 20 N b) 100 N c) 500 N d) None of these

5 A tetrahedron has four equal _____ faces

a) square b) rectangular c) triangular d) circle

6 A point is 20 mm above HP and 60 mm behind VP ,identify in which quadrant the point lies

a) First Quadrant b) Second Quadrant c)Third Quadrant d)Fourth Quadrant

7 Which is the most common air pollutant

a) NO_2 b)NO c) NO_3 d) N_2O_3

8 The Air Pollution and Control Act, popularly known as the 'Air Act' was passed for the first time in US in

a) 1955 b) 1999 c) 2004 d) 2015

9 Probability of a product successfully operation for a specific period of time is called

a) reliability b) durability c) conformance d) serviceability

10 A limit or restriction on the features or behaviour of a design is termed

a) Design objective b) Design function c) Design Constraint d) None of the above

11 A space-time of 3 hours for a flow reactor means that

a) The time required to process one reactor volume of feed (measured at specified conditions) is 3 hour

b) Three reactor volumes of feed can be processed every hour

c) It takes three hours to dump the entire volume of the reaction with feed

d) Conversion is cent percent after three hour

12 The rate of the chemical reaction $A \rightarrow B$ doubles as the concentration of A *i.e..*, C_A is doubled. If rate of reaction is proportional to C_A^n, then what is the value of n for this reaction?

a) A.0.5 b) B. 1 c) C. 0 d) D. 2

13 Match the following

P. Activated Complex	I. Enzymatic reactions
Q. Michelis-Menton constant	II.Transition state theory
R. Parabolic velocity profile	III. Ammonia synthesis
S. Solid catalysed reactions	IV. Laminar Flow Reactor

a) P-I Q-II R-III S-IV b) P-III Q-II R-I S-IV
c) P-II Q-I R-IV S-III c) P-IV Q-III R-II S-I

14 An ideal gas at temperature T1 and pressure P1 is compressed isothermally to pressure P2 (> P1) in a closed system. Which of the following is true for internal energy (U) and Gibbs free energy (G) of the gas at the two states?

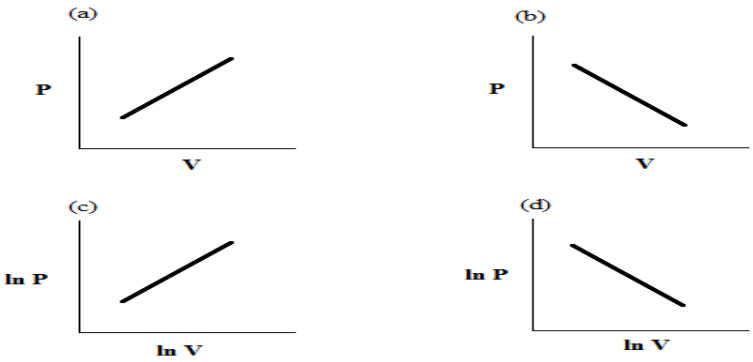
a)U1 = U2, G1 > G2 b) U1 = U2, G1 < G2

c)U1 > U2, G1 = G2 d) U1 < U2, G1 = G2

15 An equimolar liquid mixture of species 1 and 2 is in equilibrium with its vapour at 400K.At this temperature, the vapour pressures of the species are P_1^{sat} =180 kPa and P_2^{sat} =120 kPa. Assuming that Raoult's law is valid, the value of $y_1$is

a)0.30 b) 0.41 c) 0.50 d) 0.60

16 In a closed system, the isentropic expansion of an ideal gas with constant specific heat is represented by



17 Which of the following has the minimum value of COP for a given refrigeration effect?

a) Reverse Carnot cycle
b) Ordinary vapour-compression cycle.
c) Vapour-compression process with a reversible expansion engine.
d) Air refrigeration cycle

18 If T_A and T_B are the boiling points of pure A and pure B respectively and T_{AB} is that of a non homogeneous immiscible mixture of A and B, then
a)$T_{AB} < T_A$ and T_B b) $T_{AB} > T_A$ and T_B
c)$T_A > T_{AB} > T_B$ d) $T_B > T_{AB} > T_B$

19 A gas at 2 atm pressure is above critical temperature and is kept in a pressure vessel. The pressure on the gas is now increased to 500 atm. One of the following will occur. Choose the correct answer.
a) All the gas will condense to liquid b)There will not be any condensation at all.
c) Practical condensation occurs d)The vessel will burst

20 For the same residence time, which one will give the maximum conversion?
a) Single stirred tank (v = 5 litres).
b) Two stirred tank (each of 2.5 litres) in series.
c) Stirred tank followed by tubular flow reactor (each of 2.5 litres).
d) Single tubular flow reactor (v = 5 litres).

21 For a pure substance, the Maxwell's relation obtained from the fundamental property relation dU=TdS – PdV is
a) $\left(\frac{\partial T}{\partial V}\right)_S = -\left(\frac{\partial P}{\partial S}\right)_V$ b) $\left(\frac{\partial P}{\partial T}\right)_V = \left(\frac{\partial S}{\partial V}\right)_T$ c)$\left(\frac{\partial T}{\partial P}\right)_S = \left(\frac{\partial V}{\partial S}\right)_P$ d)$\left(\frac{\partial V}{\partial T}\right)_P = -\left(\frac{\partial S}{\partial P}\right)_T$

22 The half life of an nth order reaction in a batch reactor depends on
a) Only the rate constant
b) Only the rate constant and the order of the reaction
c)Only the rate constant and initial reactant concentration
d)The rate constant, initial reactant concentration and the order of the reaction

23 Radioactive solid nuclear wastes are disposed off by
a) high temperature incineration. b)pathological incineration
c) pyrolysis. d)underground burial in concrete containers

24 The ratio of average fluid velocity to the maximum velocity in case of laminar flow of a Newtonian fluid in a circular pipe is
a)0.5 b) 1 c) 2 d) 0.6

25 The head loss in turbulent flow in a pipe varies
a)As velocity b) as $(\text{velocity})^2$
c) inversely as the square of diameter d) inversely as the velocity

26 The magnitude of the force (in N) required to hold a body of volume 0.05 m3 and mass 40 kg in water (density 1000 kg/m3) at a depth of 0.1 m is (g = 9.81 m/s2).
a) b) 98.1 c) 490.5 d) 882.9

27 Uniformity coefficient is defined as
a) ratio of sieve size in mm through which 60 % of sample of sand will pass to the effective size of the sand.
b) size of the sieve in mm through which 10 % of the sample of sand by mass will pass.
c) size of the sieve in mm through which 60 % of the sample of sand by mass will pass.
d) ratio of sieve size in mm through which 10 % of sample of sand will pass to the effective size of the sand.

28 For a mixed flow reactor operating at steady state, the rate of reaction is given by
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A $\frac{F_{A_0}}{V} - \frac{dC_A}{dt}$ B $\frac{F_{A_0}}{V} + \frac{dC_A}{dt}$

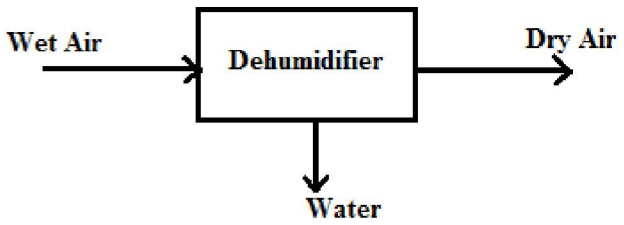
C $\frac{F_{A_0}}{V} . X_A$ D $- \frac{dC_A}{dt}$

29 In a counter current gas absorber, both the operating and equilibrium relations are linear. The inlet liquid composition and the exit gas composition are maintained constant. In order to increase the absorption factor
a)The liquid flow rate should decrease
b) The gas flow rate should increase
c)The slope of the equilibrium line should increase
d)The slope of the equilibrium line should decrease

30 Lumped capacitance approach is **BEST** suited for which of the following situations?
a) natural convection cooling of a hot body in liquid
b) forced convection cooling of a hot body in liquid
c) forced convection cooling of a hot body in air
d) natural convection cooling of a hot body in air

31 The individual mass transfer coefficients (moles/m2 .s) for absorption of a solute from a gas mixture into a liquid solvent are, KL = 4.5 and KG = 1.5. The slope of the equilibrium line is 3. Which of the following resistance (s) is (are) controlling?
a)liquid side b) gas side c) interfacial d) both liquid and gas side

32 A dehumidifier (shown below) is used to completely remove water vapour from air.

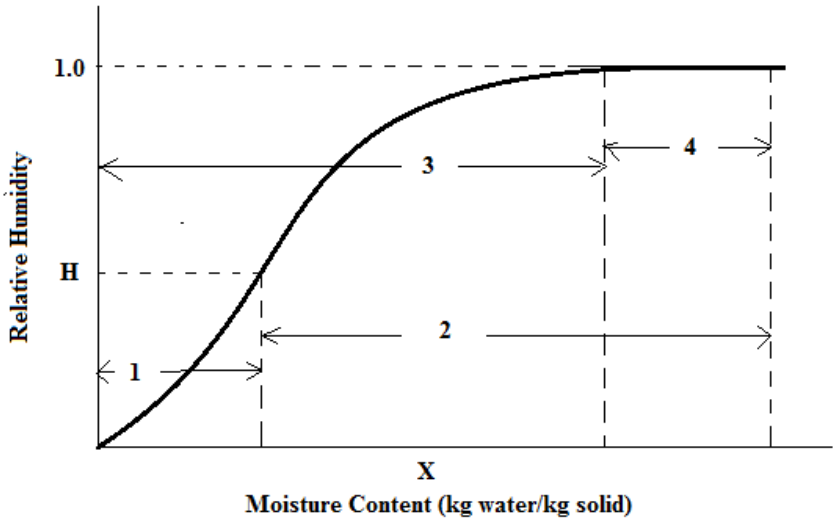


Which of the following statements is true?

a) Water is the only tie component b) Air is the only tie component

c)Both water and air are tie components d) There are no tie components

33 The equilibrium moisture curve for a solid is shown below. the total moisture content of the solid is X and it is exposed to air of relative humidity H. in the table below, group 1 lists the type of moisture and group 2 represents the region in the graph



Group 1	Group 2
(P) Equilibrium Moisture	1. 1
(Q) Bound Moisture	2. 2
(R) Unbound Moisture	3. 3
(S) Free Moisture	4. 4

Which of the following is the correct match?

a) P -1, Q – 2, R – 3, S – 4 b) P -1, Q – 3, R – 4, S - 2

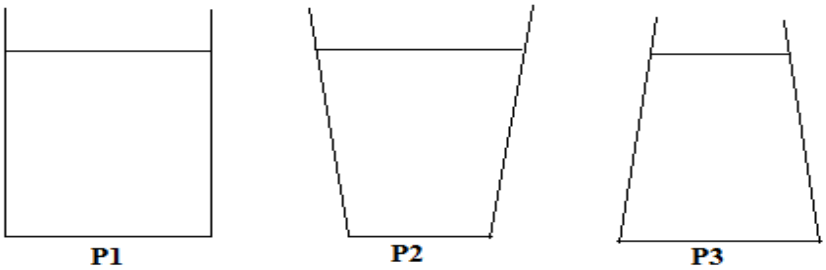
c) P -1, Q – 4, R – 2, S – 3 d) P -1, Q – 2, R – 4, S - 3

34 Assuming the mass transfer coefficients in the gas and liquid phases are comparable, the absorption of CO_2 from reformer gas(CO_2+H_2) into an aqueous solution of diethanolamine is controlled by

a) gas phase resistance b) liquid phase resistance

c) both gas and liquid phase resistances d) composition of the reformer gas

35 Three containers are filled with water up to the same height as shown. The pressures at the bottom of the container are denoted by P_1, P_2 and P_3 respectively. Which one of the following relationships is true?



a)$P_3 > P_1 > P_2$ b) $P_2 > P_1 > P_3$

c)$P_1 > P_2 = P_3$ d) $P_1 = P_2 = P_3$

36 24. Match the equipments in group 1 to the internals in group 2

Group 1	Group 2
(P) Centrifugal pump	(1) Baffle
(Q) Distillation Column	(2) Impeller
(R) Heat Exchanger	(3) Tray
	(4) Volute

a)P - 2, Q - 1, R – 4 b)P - 2, Q - 4, R – 3 c)P - 1, Q - 3, R – 4 d)P - 4, Q - 3, R - 1

37 A globe valve is the most suitable for applications, in which
a) fluid flow control is required
b) fluid contains dispersed solid particles
c) valve is required to be either fully open or fully closed
d) one way flow is required.

38 2. Match the following.

Group 1	Group 2
(P) Turbulence	(1) Reciprocating Pump
(Q) NPSH	(2) Packed bed
(R) Ergun Equation	(3) Fluctuating velocity
(S) Rotameter	(4) Impeller
(T) Power Number	(5) Vena contracta

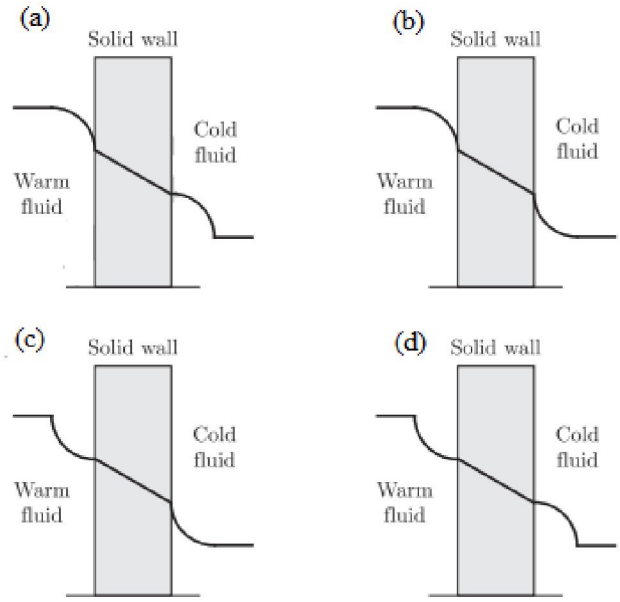
a)P - 3, R - 2, T – 4 b) Q - 5, R - 2, S - 3

c)P - 3, R - 4, T – 2 d) Q - 3, S - 5, T - 4

39 Water is flowing through a pipe of 3.8 cm diameter under a pressure of 20 N/cm^2 (gauge) and with mean velocity of 3.7 m/s. Find the total head or total energy per unit weight of the water at a cross section, which is 7 m above the datum line.

a) 56.14 m b) 28.07 m c) 84.18 m d) 10.52 m

40 The temperature profile for heat transfer from one fluid to another separated by a solid wall is



41 The Prandtl number of a fluid is the ratio of

a) Thermal diffusivity to momentum diffusivity

b) Momentum diffusivity to thermal diffusivity

c) Conductive resistance to convective resistance

d) Thermal diffusivity to kinematic viscosity

42 In a heat exchanger, the rate of heat transfer from the hot fluid to the cold fluid

a) varies directly as the area and the LMTD.

b) directly proportional to LMTD and inversely proportional to the area

c) varies as square of the area.

d) none of these.

43 Steam economy of a multiple effect evaporator system is defined as

a) Kilogram of steam used per hour

b) Kilogram of steam consumed in all the effects for each kilogram of steam fed

c) Kilogram of steam used in all the effects for each kilogram of water vaporized per hour

d) Kilogram of water vaporized from all the effects for each kilogram of steam fed to the first effect.

44 Match the dimensionless numbers in group 1 with the ratios in group 2.

Group 1	Group 2
(P) Biot Number	(1) Buoyancy force / Viscous force
(Q) Schmidt Number	(2) internal thermal resistance / boundary layer resistance
(R)Grashoff Number	(3) momentum diffusivity / mass diffusivity

a) P – 2, Q – 1, R – 3 b) P – 1, Q – 3, R – 2
c) P – 3, Q – 1, R – 2 d) P – 2, Q – 3, R – 1

45 In case of inviscid flow over a flat plate

a) There is no hydrodynamic boundary layer formation
b) The hydrodynamic boundary layer is formed at some distance from the leading edge
c) The hydrodynamic boundary layer is formed, but is of constant thickness all along the plate
d) The hydrodynamic boundary layer is always thicker than the thermal boundary layer

46 In case of radial systems, considering one-dimensional heat transfer in radial direction with no heat generation, which of the following is TRUE?

a) Both heat transfer rate and heat flux are constant
b) Heat flux increases with radius while heat transfer rate remains constant
c) Heat flux remains constant while heat transfer rate changes radially
d) Heat flux decreases with radius while heat transfer rate remains constant

47 The process by which nitrate nitrogen is converted biologically to nitrogen gas in the absence of oxygen is
a)Facultative process b) Anoxic process c)Aerobic Process d) all the above

48 Most efficient and suitable dust removal equipment for removal of flyash from flue gas in a thermal power plant is the
a)gravity settling chamber b) cyclone separator
c)electrostatic precipitator d) bag filter

49 The environmental lapse rate is found to be:

a)-10°C/km b) 8.6°C/km c) 6.5°C/km d) -5.6°C/km

50 Which of the following is not a secondary air pollutant?
a)Ozone b) Photochemical smog c)Sulphur dioxide d) All (a), (b) & (c)

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